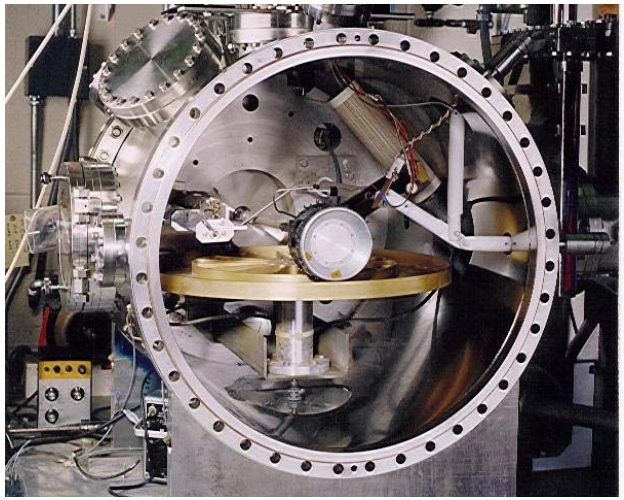
Space Mechanisms Accelerated Test Chamber

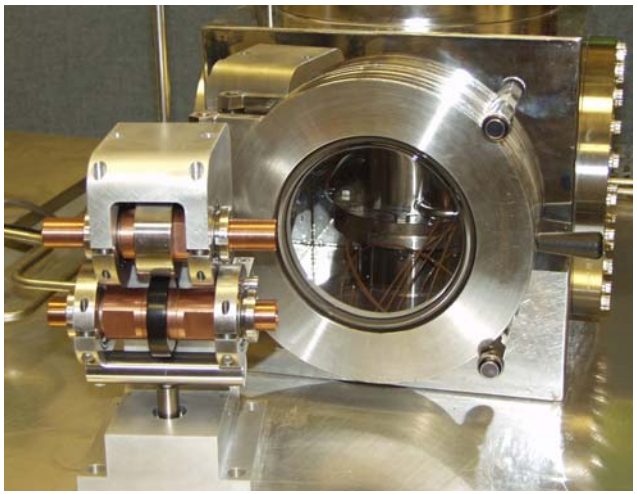
- Generic test chamber for multiple purposes
- Size: 60 cm (24") outside dia x 60 cm long
- Mechanisms can be driven internally or via ferrofludic feedthrough
- Vacuum level to 10^{-4} Pa (10^{-7} torr)
- Low temperatures via liquid nitrogen cooling
- Outgassing products measured via mass spectroscopy
- Used to calibrate hardware for Mars Pathfinder Wheel Abrasion Experiment



Space mechanisms accelerated test chamber with Mars Pathfinder wheel experiment inside

Traction Drive Test Device

- Simple device in small vacuum cube for testing solid lubricant coatings and traction roller materials
- External motor and eddy current brake connected via ferrofludic feedthroughs
- Controlled torque and normal load
- Measurements: traction coefficient, torque capacity, torque ripple, roller durability, creep (slip), temperature capability
- Vacuum level to 10^{-5} Pa (10^{-8} torr)
- Temperatures to -45 ^{o}C (or lower if liquid nitrogen cooled)



Traction test device with vacuum cube

For further information about Mechanical Components Branch research and facilities, please see our web site:
www .grc.nasa.gov/WWW/5900/5950/
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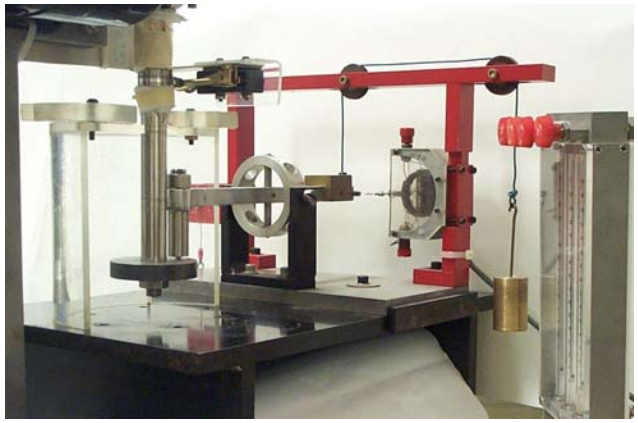
Space Mechanisms Facilities

Overview of facilities of the Mechanical Components Branch at NASA Glenn Research Center

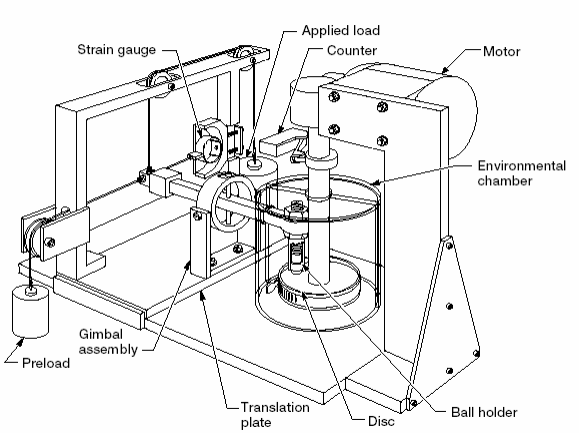
The Space Mechanisms Team employs several devices for accelerated tribological testing of space mechanisms and components. These devices are used to investigate the effect of solid or liquid lubricants and coatings on the friction, variation of friction force, wear and life of specimens under simulated conditions. Often the condition simulated is high vacuum, but some tests can be made using a controlled atmosphere, such as dry nitrogen or argon. Some tests are also conducted in dry or humid air as well. Testing in humid air can simulate conditions encountered from a delayed spacecraft launch.

Pin-on-Disk Tribometers

- Evaluates tribological materials for aerospace
- Tests liquid or solid lubricated or coated disk with various pin materials
- Hemispherical-tipped pin or ball slides against rotating disk
- Measures friction coefficient, wear rate, coating life
- Loads to 9.8 N
- Speeds to 200 rpm, 0.53 m/s with 50.8 mm disk
- Controlled atmosphere (humid or dry air, dry nitrogen, dry argon)
- Wear determined through profilometry measurement



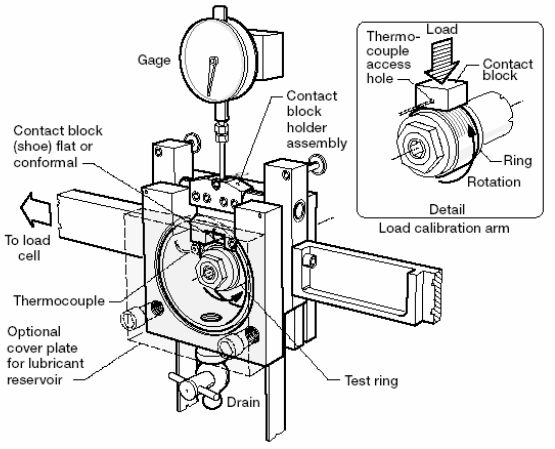
Pin-on-disk tribometer



Pin-on-disk tribometer schematic

Block-on-Ring Tribometer

- Evaluates tribological materials for aerospace applications
- Tests either liquid or dry lubricants
- A rotating ring slides against either a flat or conforming block
- With solid lubricants, the coating is applied to a metallic ring slid against a metallic or ceramic block
- With composite solid lubricants, the block is made from composite slid against metallic or composite ring
- With liquid lubricants, a metallic or ceramic block is slid against a ring dipped into lubricant reservoir

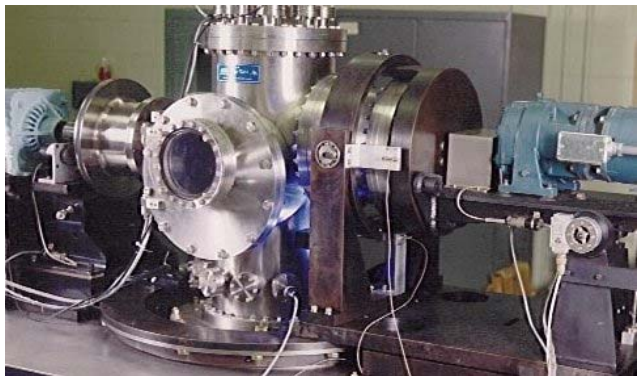


Block-on-ring tribometer

- Loads to 2800 N (630 lb), Hertz stress 760 MPa (110,000 psi)
- Speeds to 1300 rpm, 2.4 m/s (468 ft/min)
- Temperature to 233 ^{o}C (450^{o}F)
- 35 mm (1 ⅜") diameter ring and 6.3 mm (¼") wide block (flat or conforming)
- Controlled atmosphere
- ASTM standards: D-2714-94 and D2981-94

Vacuum Roller Contact Rig

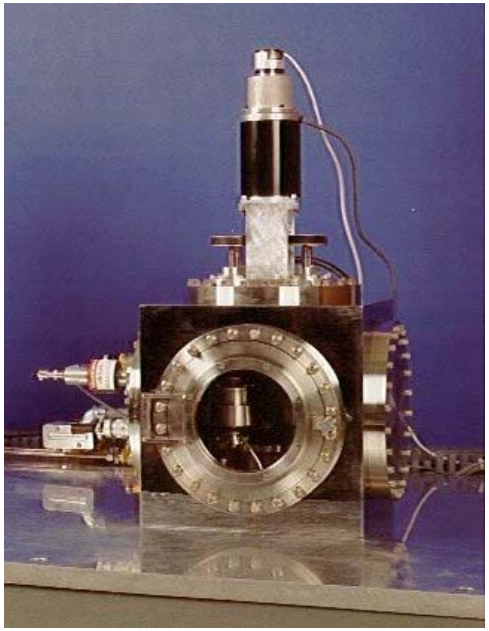
- Tests traction rollers under vacuum or controlled atmosphere
- Lubricated or dry traction conditions
- Evaluates roller traction and wear under spin, creep and sliding conditions
- Measures friction coefficients and traction coefficients
- Metallic, polymeric, ceramic or coated roller specimens
- Surface speeds to 0.9 m/s (180 ft/min), normal loads to 900 N (200 lb)
- Contact stress to 2800 MPa (400,000 psi) for steel specimens
- Torque to 23 N-m (200 in-lb)
- Axial thrust to 900 N (200 lb)
- Misalignment to ± 1.7 deg
- Vacuum level to 10^{-4} Pa (10^{-7} torr)



Vacuum roller contact rig

Vacuum Bearing Rig

- Evaluates torque and life of rolling element bearings
- Allows long duration tests of one to four pairs of bearings
- Continuous rotation or oscillating (dither) motion
- Speeds to 4800 rpm
- Vacuum level to 10^{-5} Pa (10^{-8} torr)
- Bearings can be heated or cooled (-40 to +50 ^{o}C)
- Solid or grease lubricants
- Outgassing evaluated via RGA mass spectrometry
- Computer monitored torque measurement
- Tests No. 1219 or 7008 size spacecraft bearings in preloaded pairs (other sizes possible)



Vacuum bearing rig